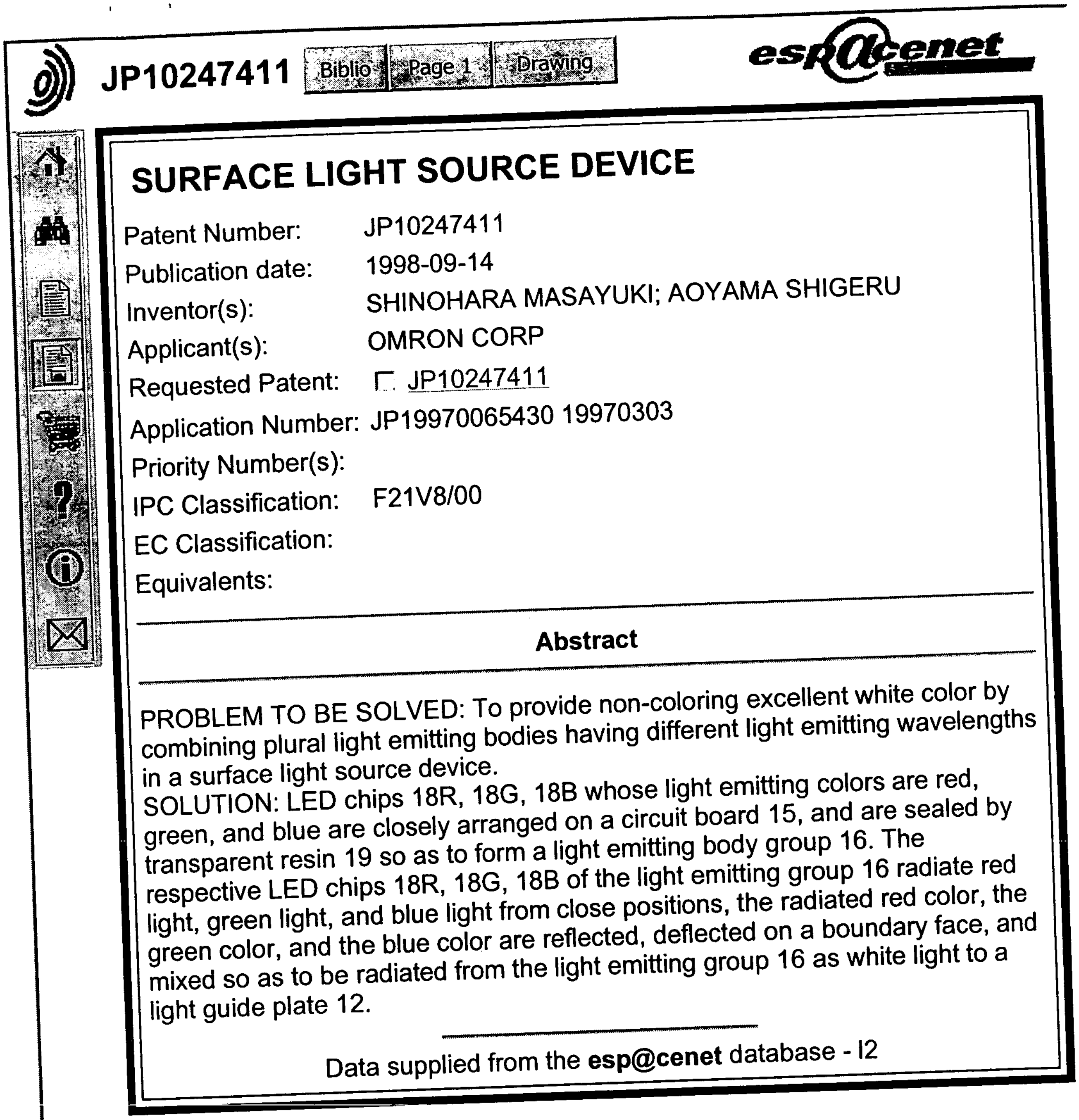

SURFACE LIGHT SOURCE DEVICE

Patent Number: JP10247411
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Requested Patent: ☐ JP10247411
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EC Classification:
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Abstract

PROBLEM TO BE SOLVED: To provide non-coloring excellent white color by combining plural light emitting bodies having different light emitting wavelengths in a surface light source device.
SOLUTION: LED chips 18R, 18G, 18B whose light emitting colors are red, green, and blue are closely arranged on a circuit board 15, and are sealed by transparent resin 19 so as to form a light emitting body group 16. The respective LED chips 18R, 18G, 18B of the light emitting group 16 radiate red light, green light, and blue light from close positions, the radiated red color, the green color, and the blue color are reflected, deflected on a boundary face, and mixed so as to be radiated from the light emitting group 16 as white light to a light guide plate 12.

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審査請求 未請求 請求項の数12 ＦＤ （全 ９ 頁）

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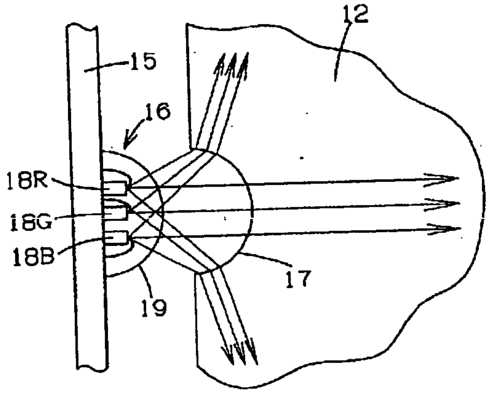
(54)【発明の名称】 面光源装置

(57)【要約】

【課題】 面光源装置において、異なる発光波長を有する複数の発光体の組合せてよって色づきのない良好な白色光を得ることができるようにする。

【解決手段】 回路基板１５上に、発光色が赤色、緑色及び青色のＬＥＤチップ１８Ｒ，１８Ｇ，１８Ｂを近接させて配置し、透明樹脂１９で封止して発光体群１６を形成する。発光体群１６の各ＬＥＤチップ１８Ｒ，１８Ｇ，１８Ｂは近接した位置から赤色光、緑色光及び青色光を出射し、出射された赤色光、緑色光及び青色光は、透明樹脂１９の界面で反射／屈折して混じり合い、発光群１６から白色光として導光板１２へ出射される。



【特許請求の範囲】

【請求項１】　一方主面より光を出射させるための導光板と、当該導光板の端面に対向させた発光素子とを備えた面光源装置において、
前記発光素子は、発光波長の異なる複数の発光体を近接配置することによって形成された発光体群を有していることを特徴とする面光源装置。

【請求項２】　前記発光素子が、前記発光体群を複数有していることを特徴とする、請求項１に記載の面光源装置。

【請求項３】　前記発光体群の両側に反射壁を形成したことを特徴とする、請求項１に記載の面光源装置。

【請求項４】　前記発光体群を樹脂で封止したことを特徴とする、請求項１に記載の面光源装置。

【請求項５】　前記発光体群に対向させて、導光板の端面に光拡散パターンを形成したことを特徴とする、請求項１に記載の面光源装置。

【請求項６】　前記発光体群を構成する同一波長の発光体の、全体としての発光パワーが、各波長でほぼ同じとなるようにしたことを特徴とする、請求項１に記載の面光源装置。

【請求項７】　前記発光体群を構成する発光体は、各波長毎に対称に配置されていることを特徴とする、請求項１に記載の面光源装置。

【請求項８】　前記発光体群を構成する同一波長の発光体は、発光体間の間隔がほぼ均等になるように配置されていることを特徴とする、請求項１に記載の面光源装置。

【請求項９】　一方端面より光を導入して一方主面より光を出射させるための導光板と、発光波長の異なる複数の発光体とからなり、各発光体が導光板の前記端面に対向させて分散配置された面光源装置において、
同一波長の発光体の、全体としての発光パワーが、各波長でほぼ同じとなるようにしたことを特徴とする面光源装置。

【請求項１０】　一方端面より光を導入して一方主面より光を出射させるための導光板と、発光波長の異なる複数の発光体とからなり、各発光体が導光板の前記端面に対向させて分散配置された面光源装置において、
波長の異なる各発光体を、発光体個数の少ない発光体から優先してほぼ均等となるように配置したことを特徴とする面光源装置。

【請求項１１】　同一波長の発光体の、全体としての発光パワーが、各波長でほぼ同じになるように各発光体の使用時消費電力を調整されていることを特徴とする、請求項９に記載の面光源装置。

【請求項１２】　光源数が比較的少なくて発光量が大きな発光体に対向させて拡散作用の高い光拡散手段を設け、光源数が比較的多くて発光量が小さな発光体に対向させて拡散作用の低い光拡散手段を設けたことを特徴とする、請求項９又は１０に記載の面光源装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は面光源装置に関する。特に、赤（Ｒ）、緑（Ｇ）、青（Ｂ）の３色の発光ダイオードからなる発光体群を備えた発光素子を用いた面光源装置に関するものである。

【０００２】

【従来の技術】単色の発光体を備えた面光源装置にあっては、単色（例えば、緑色）の発光ダイオード（以下、ＬＥＤという）チップを回路基板上に複数個実装した発光素子を導光板の端面（光入射端面）に対向させている。

【０００３】カラー液晶表示装置に用いる面光源装置にあっても、これと同様に構成されており、図１に示すように、回路基板２に沿って赤（Ｒ）、緑（Ｇ）、青（Ｂ）の３色のＬＥＤチップ３Ｒ，３Ｇ，３Ｂが一定ピッチ毎に配列させて発光素子１が形成されている。そして、この発光素子１を導光板４の光入射端面５に対向させて配置している。

【０００４】しかし、このような発光素子を用いた場合には、導光板の光入射端面の近傍では光出射面から出る光が虹色に色づくという問題があった。すなわち、発光素子の近傍では赤、緑、青の３色が均一に混じり合わないため、赤、緑、青の各色のＬＥＤチップの直前ではそれぞれ赤色、緑色、青色に色づき、それらの中間では混色になり、ある程度光入射端面から離れないと白色光を得ることができなかった。このため、面光源装置の上にカラー用の液晶表示パネルを重ねて液晶表示装置を構成した場合、液晶表示パネルの画像が端部で色づくという問題があった。あるいは、画像の色づきを防止しようとすれば、面光源素子の光入射端面の近傍を使わないようにする必要があり、面光源装置の利用効率が低下し、必要な発光面積に比較して面光源装置が大きくなるという問題があった。

【０００５】

【発明が解決しようとする課題】本発明は叙上の従来例の欠点に鑑みてなされたものであり、その目的とするところは、異なる発光波長を有する複数の発光体の組合せてよって色づきのない良好な白色光を得ることができる発光素子を用いた面光源装置を提供することにある。

【０００６】

【発明の開示】請求項１に記載の面光源装置は、一方主面より光を出射させるための導光板と、当該導光板の端面に対向させた発光素子とを備えた面光源装置において、前記発光素子は、発光波長の異なる複数の発光体を近接配置することによって形成された発光体群を有していることを特徴としている。

【０００７】従来の面光源装置が、発光体から出た波長の光を導光板内で混合して白色化していたのに対し、請

求項１の面光源装置にあっては、発光波長の異なる発光体を近接配置して発光体群が形成されており、発光体群で波長の異なる光を混合して白色光として導光板へ出射させている。

【０００８】従って、導光板の光入射側の端部で導光板から出る光の色づきが大幅に低減され、良好な白色光を得ることができる。

【０００９】特に　発光体群を複数設ければ、白色の点光源を複数設けたのと同様な発光素子を得ることができ、大きな導光板の場合にも色づきなく白色光を出射させることができる。

【００１０】また、発光体群の両側に反射壁を形成したり、発光体群を樹脂で封止したり、発光体群に対向させて導光板の端面に光拡散パターンを形成したりすることにより、導光板入射光輝度角分布のばらつきを小さくできる。

【００１１】さらに、発光体群を構成する同一波長の発光体の、全体としての発光パワーが、各波長でほぼ同じとなるようにすれば、各発光体の輝度ばらつきを調整して全体として良好な白色光を得ることができる。

【００１２】また、発光体群を構成する発光体は、各波長毎に対称に配置すれば、光の波長分布が対称となり、光学特性の良好な白色光を得ることができる。

【００１３】さらに、発光体群を構成する同一波長の発光体を、発光体間の間隔がほぼ均等になるように配置すれば、各波長の光の輝度むらをなくし、白色光の色づきをより一層低減することができる。

【００１４】請求項９に記載の面光源装置は、一方端面より光を導入して一方主面より光を出射させるための導光板と、発光波長の異なる複数の発光体とからなり、各発光体が導光板の前記端面に対向させて分散配置された面光源装置において、同一波長の発光体の、全体としての発光パワーが、各波長でほぼ同じとなるようにしたことを特徴としている。

【００１５】例えば、発光体個数を調整する以外にも、同一波長の発光体の、全体としての発光パワーが、各波長でほぼ同じになるように各発光体の使用時消費電力を調整することもできる。

【００１６】波長の異なる複数の発光体を導光板に沿って分散配置している場合でも、各波長の発光体毎に全体の発光パワーがほぼ同じになるようにすることにより、各波長の発光体から出る光量がほぼ均等となり、白色光の色づきを低減することができる。

【００１７】請求項１０に記載の面光源装置は、一方端面より光を導入して一方主面より光を出射させるための導光板と、発光波長の異なる複数の発光体とからなり、各発光体が導光板の前記端面に対向させて分散配置された面光源装置において、波長の異なる各発光体を、発光体個数の少ない発光体から優先してほぼ均等となるように配置している。

【００１８】この面光源装置にあっては、発光体個数の少ない発光体から優先して発光体間隔がほぼ均等となるように各発光体を配置しているから、各発光波長の光を合理的に均等化でき容易に色むらをなくすことができる。

【００１９】光源数が比較的少なくて発光量が大きな発光体に対向させて拡散作用の高い光拡散手段を設け、光源数が比較的多くて発光量が小さな発光体に対向させて拡散作用の低い光拡散手段を設けることにより、素子の特性を補償することができるので、色づきのすくない白色光源を得ることができる。

【００２０】

【発明の実施の形態】図２は本発明の一実施形態による面光源装置１１を示す平面図である。ポリカーボネイト樹脂やメタクリル樹脂等の高屈折率の透明樹脂材料からなる導光板１２の下面には、凹凸加工や拡散インクのドット印刷等によって形成された拡散パターン（図示せず）が適当な密度及び密度の変化を持たせて形成されている。導光板１２の光入射端面１３には、発光素子１４が対向している。この発光素子１４は、回路基板１５の前面に、複数の発光体群１６を適当な間隔をおいて形成したものであって、導光板１２の光入射端面１３には、発光体群１６と対向して円弧状の凹部１７が形成されている。また、導光板１２の下面には、光の漏れによる損失を防止するための反射シート（図示せず）が配設されている。

【００２１】この1つの発光体群１６を図3に示す。発光体群１６は、発光色が赤色（Ｒ）のＬＥＤチップ１８Ｒと緑色（Ｇ）のＬＥＤチップ１８Ｇと青色（Ｂ）のＬＥＤチップ１８Ｂを３つ近接させて回路基板１５に実装し、透明樹脂１９によって封止したものである。しかして、発光体群１６の各ＬＥＤチップ１８Ｒ，１８Ｇ，１８Ｂが発光すると、発光体群１６においては各ＬＥＤチップ１８Ｒ，１８Ｇ，１８Ｂが近接して配置されているから、発光体群１６からは白色光が出射される。この発光体群１６から出た白色の光は、導光板１２の光入射端面１３から導光板１２内部に入る。このとき、凹部１７から導光板１２内に入る光は、図３に示すように凹部１７のカーブによって横方向にも屈折して広げられ、導光板１２全体に均一に広がる。導光板１２内部に入った光は、導光板１２内面で全反射すると共に拡散パターンで散乱され、導光板１２の光出射面２０（上面）への入射角が全反射の臨界角よりも小さくなると光出射面２０から出射される。

【００２２】従って、この面光源装置１１にあっては、各発光体群１６から赤、緑及び青色光を混合して生成された白色光が出射されるので、発光素子１４は白色光源として用いることができ、光入射端面１３の近傍でも導光板１２の光出射面２０から出る光の色づきが低減される。特に、この発光体群１６は、３つのＬＥＤチップ１

8R，18G，18Bを透明樹脂19で包んでいるのでの、各LEDチップ18R，18G，18Bから出射された赤色光、緑色光、青色光は透明樹脂19の界面で屈折及び反射を繰り返して混合される。単に3つのLEDチップ18R，18G，18Bを並べただけの場合には、導光板12に入射する光の各色の違いによって輝度角分布（導光板入射光輝度角分布）が異なることになるが、透明樹脂19で各色の光が混合される結果、導光板入射光輝度角分布の差も小さくなり、より均一な白色光源が得られる。

【0023】よって、本発明の発光素子14を用いた面光源装置11によれば、光入射端面13でも色づきがなく、均一な輝度分布を有する良好な白色面光源として用いることができる。

【0024】（第2～第5の実施形態）また、導光板入射光輝度角分布が発光色の異なるLEDチップ毎に異なるのを防止するためには、以下に説明するような種々の構造を採用することもできる。

【0025】図5に示す発光体群16は、透明樹脂19によって封止された3つのLEDチップ18R，18G，18Bの左右両側に反射壁21を設けたものである。両側に反射壁21を設けることにより、各LEDチップ18R，18G，18Bから出た光を反射壁21で反射させて光の角度を変え、各色の光を混合拡散させることにより白色光源化すると共に導光板入射光輝度角分布の違いを小さくしている。

【0026】図6に示す発光体群16は、3つのLEDチップの左右両側に反射壁21を設け、各LEDチップ18R，18G，18B及び反射壁21を透明樹脂19内に封止したものである。この実施形態にあっても、両側に反射壁21を設けることにより、各LEDチップ18R，18G，18Bから出た光を反射壁21で反射させて光の角度を変え、各色の光を混合拡散させることにより白色光源化すると共に導光板入射光輝度角分布の違いを小さくしている。

【0027】図7に示す発光体群16は、透明樹脂19によって封止された3つのLEDチップ18R，18G，18Bの上下両側に反射壁21を設けたものである。上下に反射壁21を設けることにより、各LEDチップ18R，18G，18Bから出た光を反射壁21で反射させて光の角度を変え、各色の光を混合拡散させることにより白色光源化すると共に導光板入射光輝度角分布の違いを小さくしている。

【0028】図8に示す実施形態は、導光板12の凹部17にランダムもしくは所定パターンの凹凸からなる光拡散パターン22を形成したものである。この実施形態にあっては、各LEDチップ18R，18G，18Bから出た光は、凹部17から導光板12内に入射する際、光拡散パターン22で散乱されながら不規則な方向で導光板12内に入るので、光の輝度分布をより均一化すると共に導光板入射光輝度角分布の違いを小さくできる。

【0029】（第6の実施形態）図9（a）は本発明のさらに別な実施形態による発光素子14の1つの発光体群16を表わしている。この発光体群16にあっては、複数組の各色LEDチップ18R，18G，18Bを回路基板15上に複数段に配列し、各LEDチップ18R，18G，18Bを透明樹脂19で封止している。このようにLEDチップ18R，18G，18Bを複数段に配置すると、発光素子14を上方から見た場合のLEDチップ18R，18G，18B全体の幅が小さくなるので、発光色の異なるLEDチップ18R，18G，18Bの配列による導光板入射光輝度角分布のばらつきを小さくできる。

【0030】特に、図9（b）に示すように、上段と下段とで発光色の並びを逆にするのが望ましい。配列を逆にすれば、光源の白色化と導光板入射光輝度角分布のばらつきの低減に一層の効果がある。

【0031】（第7、第8の実施形態）上記実施形態にあっては、いずれも赤色のLEDチップと緑色のLEDチップと青色のLEDチップとは同数ずつ用いている。しかし、LEDチップの発光パワーは、各素子の効率や最大定格等によって異なっており、赤色のLEDチップと緑色のLEDチップと青色のLEDチップの各最大発光パワーP_R、P_G、P_Bの比は、

$P_R : P_G : P_B = 8 : 1 : 4$

程度となっている。従って、発光素子14の各発光体群16において、各色のLEDチップ18R，18G，18Bの使用個数が、赤色LEDチップ18Rを1個、緑色LEDチップ18Gを8個、青色LEDチップ18Bを4個の比となるようにし、各色毎の発光パワーを等しくすることが望ましい。

【0032】しかし、例えば1個の赤色LEDチップ18R［図では、単にRで示す］、8個の緑色LEDチップ18G［図では、単にGで示す］、4個の青色LEDチップ18B［図では、単にBで示す］を図10のように単に配列しただけでは、左右で色が異なってしまう。これらのLEDチップ18R，18G，18Bを配列するには、図11に示すように、数の少ないLEDチップ（赤色）18Rをまず配置領域に均等となるように割り付け、次に数の少ないLEDチップ（青色）18Bを配置領域の空白位置に略均等に割り付け、最後にもっとも数の多いLEDチップ（緑色）18Gをあいている位置に割り付ける。

【0033】また、各LEDチップ18R，18G，18Bから出る光をより均一にするためには、図12に示すように、各色のLEDチップ18R，18G，18Bを配置領域にそれぞれ均一に並べ、そのまま一列に並べてもよい。

【0034】図11の配列でも図12の配列でも各LEDチップ18R，18G，18Bは左右対称に配列さ

れ、さらに、図１１のような配列では、ＬＥＤチップ１８Ｒ，１８Ｇ，１８Ｂの間隔が一定となるので、ＬＥＤチップ１８Ｒ，１８Ｇ，１８Ｂの回路基板１５への実装が容易になり、図１２のような配列では、各色の発光パワーの均一度が高くなり、白色光源化に効果がある。

【００３５】なお、図示しないが、各色のＬＥＤチップ１８Ｒ，１８Ｇ，１８Ｂを最大定格で駆動せず、各ＬＥＤチップ１８Ｒ，１８Ｇ，１８Ｂの使用時消費電力が、赤色のＬＥＤチップ１８Ｒと緑色のＬＥＤチップ１８Ｇと青色のＬＥＤチップ１８Ｂとで、１：２：８程度となるようにする方法も有効である。

【００３６】（第９の実施形態）これまでの実施形態は、各色のＬＥＤチップ１８Ｒ，１８Ｇ，１８Ｂを発光体群１６として近接させて配置することにより白色点光源化したものであったが、図１３に示すものは、導光板１２の光入射端面１３に沿って発光色の異なるＬＥＤチップ１８Ｒ，１８Ｇ，１８Ｂを配列することにより、面光源装置の白色化を図ったものである。

【００３７】即ち、図１３に示すものは、第７の実施形態のように各色のＬＥＤチップ１８Ｒ，１８Ｇ，１８Ｂの発光パワーの比を考慮して決めたＬＥＤチップ１８Ｒ，１８Ｇ，１８Ｂの配置（図１１）を利用したものである。第７の実施形態では、発光体群１６の内部におけるＬＥＤチップ１８Ｒ，１８Ｇ，１８Ｂの配置であったが、この実施例では、導光板１２の光入射端面１３に沿ったＬＥＤチップ１８Ｒ，１８Ｇ，１８Ｂの配列に利用している。

【００３８】このような配列で導光板１２の光入射端面１３に各色のＬＥＤチップ１８Ｒ，１８Ｇ，１８Ｂを配列した場合でも、全体の色バランスが良好となって良好な白色光源とすることができ、導光板１２の光出射面２０における色づきを少なくできる。

【００３９】（第１０の実施形態）また、図１４に示すものは、第８の実施形態と同様、各色のＬＥＤチップ１８Ｒ，１８Ｇ，１８Ｂを各ＬＥＤチップ１８Ｒ，１８Ｇ，１８Ｂ間の間隔は不均一であるが、各色毎のＬＥＤチップの間隔は均一となるようにしたものである（図１２参照）。

【００４０】このような配列で導光板１２の光入射端面１３に各色のＬＥＤチップ１８Ｒ，１８Ｇ，１８Ｂを配列した場合でも、全体の色バランスが良好となって良好な白色光源とすることができ、導光板１２の光出射面２０における色づきを少なくできる。

【００４１】なお、図１５に示すように、各ＬＥＤチップ１８Ｒ，１８Ｇ又は１８Ｂに対向する位置において、導光板１２の光入射端面１３に凹部１７を設けたり、図１６に示すように、光拡散パターン２２を形成したりすれば、導光板１２に入射する各色の光を導光板１２内で左右に広げて導光板１２内で均一に分布させることができる。

【００４２】（第１１の実施形態）図１７は本発明のさらに別な実施形態による面光源装置を示す平面図である。この実施形態では、導光板１２の光入射端面１３に対向させて１個の赤色ＬＥＤチップ１８Ｒと２個の青色ＬＥＤチップ１８Ｂと８個の緑色ＬＥＤチップ１８Ｇ［各ＬＥＤチップ１８Ｒ，１８Ｇ，１８Ｂを図１７では、単にＲ、Ｇ、Ｂで表わしている］とを図１６と同様な配置で設けている。こうしてＬＥＤチップ１８Ｒ，１８Ｇ，１８Ｂを対向配置された光入射端面１３のうち、赤色ＬＥＤチップ１８Ｒと対向する位置には、図１８（ａ）（ｂ）に示すような奥行の深い凹部１７Ｒを設け、緑色ＬＥＤチップ１８Ｇと対向する位置には、図１９（ａ）（ｂ）に示すような奥行の浅い凹部１７Ｇを設け、青色ＬＥＤチップ１８Ｂと対向する位置には中間の深さの凹部１７Ｂを設けている。

【００４３】図１８（ａ）（ｂ）に示すように、奥行の深い凹部１７Ｒでは、導光板１２に入射する光の拡散効果は高くなるが、凹部１７Ｒの空間から斜め上下に漏れる光量が増加するので、ＬＥＤチップと導光板１２との結合効率は小さくなる。逆に、図１９（ａ）（ｂ）に示すように、奥行の浅い凹部１７Ｇでは、導光板１２に入射する光の拡散効果は小さくなるが、ＬＥＤチップと導光板１２との結合効率は高くなる。赤色ＬＥＤチップ１８Ｒは、導光板１２との結合効率が高く、使用個数が少ないので、赤色ＬＥＤチップ１８Ｒと組合せる凹部は奥行の深いもの（１７Ｒ）とし、緑色ＬＥＤチップ１８Ｇは、導光板１２との結合効率が低く、使用個数が多いので、緑色ＬＥＤチップ１８Ｇと組合せる凹部は奥行の浅いもの（１７Ｇ）とし、青色ＬＥＤチップ１８Ｂは、導光板１２との結合効率が低く、使用個数が多いので、青色ＬＥＤチップ１８Ｂと組合せる凹部は中間の奥行のもの（１７Ｂ）とすることにより、各ＬＥＤチップ１８Ｒ，１８Ｇ，１８Ｂの光結合効率をバランスさせると共に光の拡散具合もより均一にすることができ、高輝度で輝度分布が均一な白色面光源を得ることができる。

【００４４】（液晶表示装置）図２０は本発明にかかる面光源装置８０を用いた液晶表示装置８１を示す分解斜視図である。面光源装置８０の前面には、拡散反射シート８２が配置され、その前面に液晶表示パネル８３が配設されている。液晶表示パネル８３は、透明電極やＴＦＴ、カラーフィルタ、ブラックマトリクス等を形成された２枚の液晶基板（ガラス基板、フィルム基板）８４，８５間に液晶材料を封止し、液晶基板８４，８５の両外面に偏光板８６を配設したものである。

【００４５】（液晶表示装置を備えた電子装置）本発明にかかる液晶表示装置は、携帯電話や弱電力無線機のような無線情報伝達装置、携帯用パソコン、電子手帳や電卓のような情報処理装置などに用いるのに好ましい。図２１は本発明にかかる例えば図２０に示したような液晶表示装置８１をディスプレイ用に備えた携帯電話８９を

示す斜視図、図２２はその機能ブロック図である。携帯電話８９の正面にはダイアル入力用のテンキー等のボタンスイッチ９０を備え、その上方に液晶表示装置８１が配設され、上面にアンテナ９１が設けられている。しかして、ボタンスイッチ９０からダイアル等を入力すると、入力されたダイアル情報等が送信回路９２を通じてアンテナ９１から電話会社の基地局へ送信される。一方、入力されたダイアル情報等は液晶駆動回路９３へ送られ、液晶表示装置８１が液晶駆動回路９３により駆動されてダイアル情報等が液晶表示装置８１に表示される。

【００４６】また、図２３は本発明にかかる例えば図２０に示したような液晶表示装置８１をディスプレイ用に備えた電子手帳や携帯用パソコン等の携帯情報端末機９４を示す斜視図、図２４はその機能ブロック図である。携帯情報端末機９４は、カバー９５を開くと、キー入力部９６と液晶表示装置８１を備えており、内部には液晶駆動回路９３や演算処理回路９７等が設けられている。しかして、例えばキー入力部９６からテンキーやカナキー等を入力すると、入力情報が液晶駆動回路９３に送られて液晶表示装置８１に表示される。ついで、演算キー等の制御キーを押すと、演算処理回路９７で所定の処理や演算が実行され、その結果が液晶駆動回路９３に送られて液晶表示装置８１に表示される。

【００４７】なお、上記各実施形態の発光素子では、ＬＥＤチップもしくは発光体群は回路基板の上に形成していたが、これらをリードに実装したタイプの発光素子であってもよい。

【図面の簡単な説明】

【図１】従来の面光源装置を示す概略平面図である。

【図２】本発明の一実施形態による面光源装置を示す平面図である。

【図３】同上の作用説明図である。

【図４】同上の作用説明図である。

【図５】本発明の別な実施形態による発光体群を示す概略図である。

【図６】本発明のさらに別な実施形態による発光体群を示す概略図である。

【図７】本発明のさらに別な実施形態による発光体群を示す斜視図である。

【図８】本発明のさらに別な実施形態による発光体群と導光板の凹部を示す概略図である。

【図９】（ａ）は本発明のさらに別な実施形態による発光体群を示す斜視図、（ｂ）は当該発光体群におけるＬＥＤチップの配置を示す図である。

【図１０】３色のＬＥＤチップの配列の一例を示す図である。

【図１１】好ましいＬＥＤチップの配列を説明するための図である。

【図１２】好ましいＬＥＤチップの配列を説明するための図である。

【図１３】本発明のさらに別な実施形態による面光源装置におけるＬＥＤチップの配列を示す図である。

【図１４】本発明のさらに別な実施形態による面光源装置におけるＬＥＤチップの配列を示す図である。

【図１５】本発明のさらに別な実施形態による面光源装置の一部破断した平面図である。

【図１６】本発明のさらに別な実施形態による面光源装置の一部破断した平面図である。

【図１７】本発明のさらに別な実施形態による面光源装置を示す概略平面図である。

【図１８】（ａ）（ｂ）は同上の作用説明図である。

【図１９】（ａ）（ｂ）は同上の作用説明図である。

【図２０】本発明の面光源装置を用いた液晶表示装置の分解斜視図である。

【図２１】本発明にかかる液晶表示装置をディスプレイ用に備えた携帯電話を示す斜視図である。

【図２２】同上の携帯電話において液晶表示装置を駆動するための構成を示すブロック図である。

【図２３】本発明にかかる液晶表示装置をディスプレイ用に備えた電子手帳等の携帯情報端末機を示す斜視図である。

【図２４】同上の携帯情報端末機において液晶表示装置を駆動するための構成を示すブロック図である。

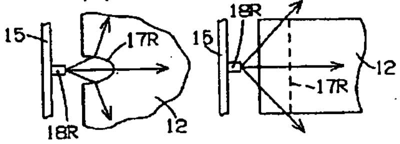
【符号の説明】

１２　導光板
１３　光入射端面
１４　発光素子
１５　回路基板
１６　発光体群
１８R，１８G，１８B　ＬＥＤチップ
１９　透明樹脂
２１　反射壁
２２　光拡散パターン

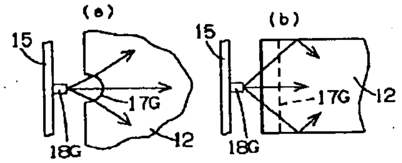
【図１０】

B	B	G	G	G	G	G	G	G	G	R

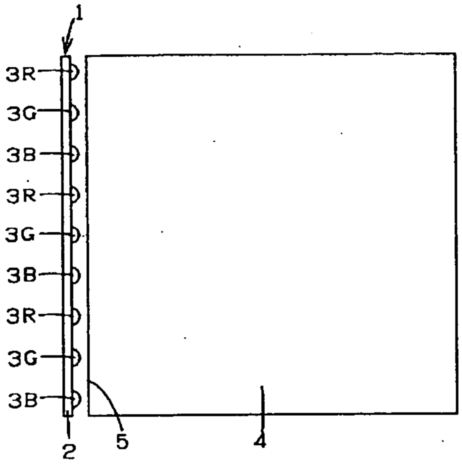
【図１８】



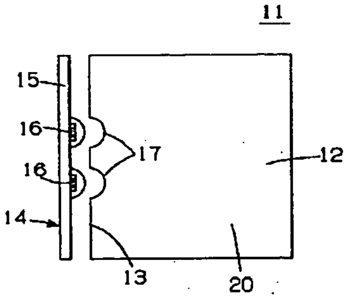
【図１９】



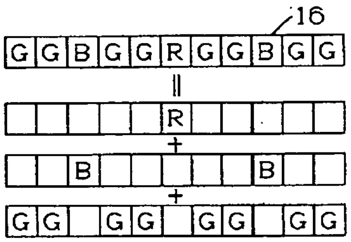
【図１】



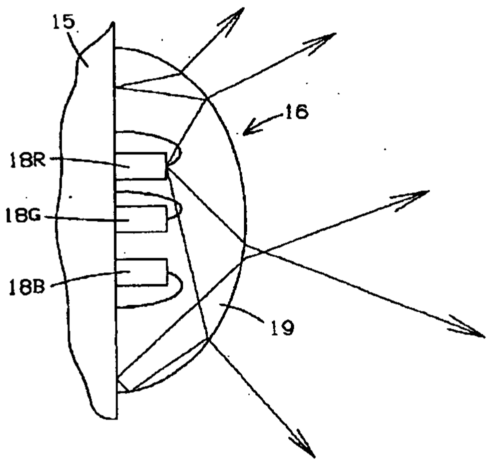
【図２】



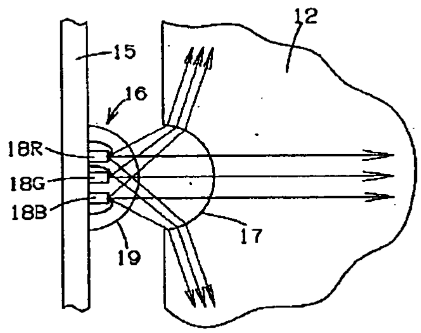
【図１１】



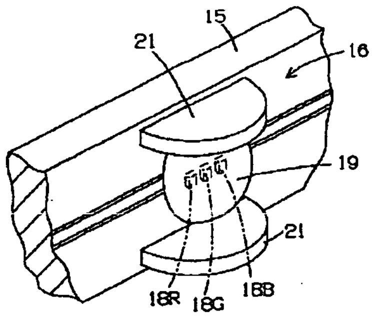
【図４】



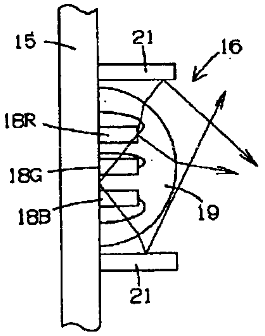
【図３】



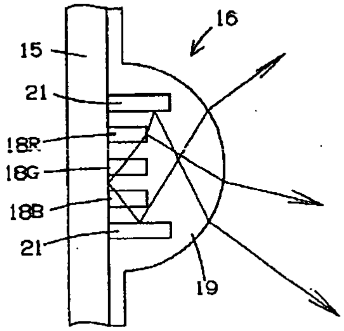
【図７】



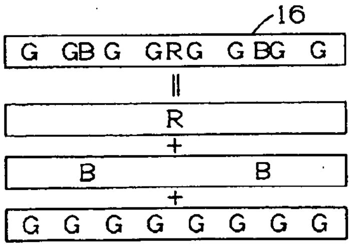
【図５】



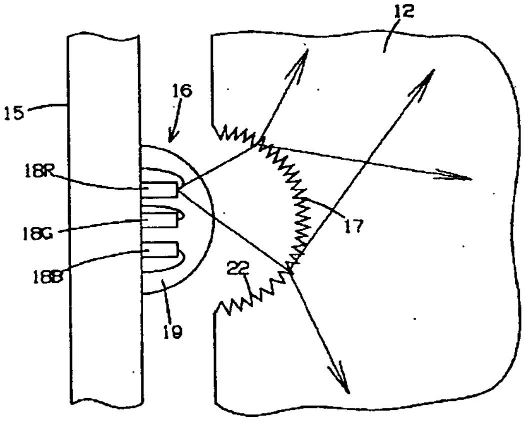
【図６】



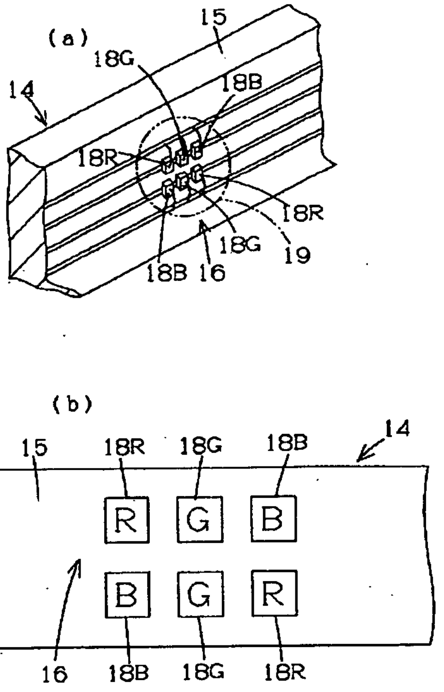
【図１２】



【図8】



【図9】



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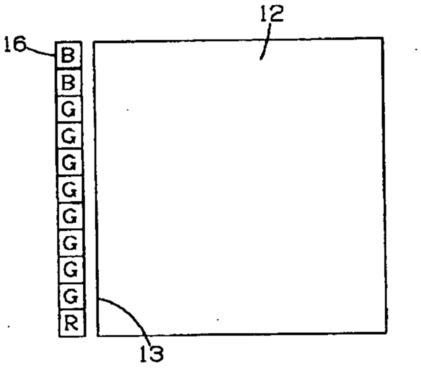

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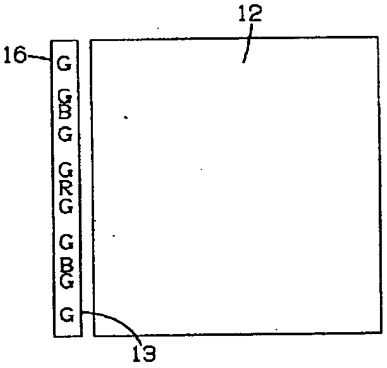

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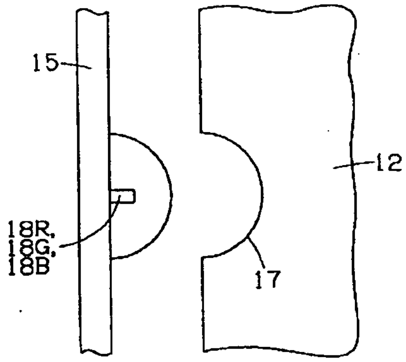

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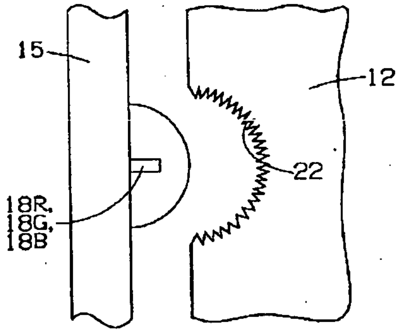

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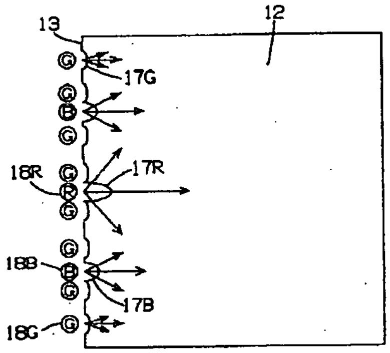

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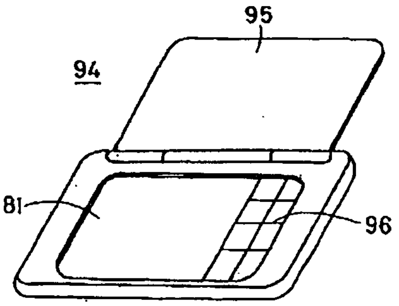

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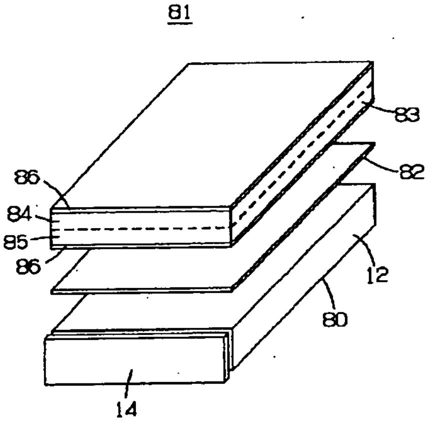
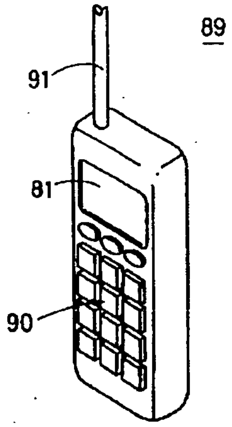
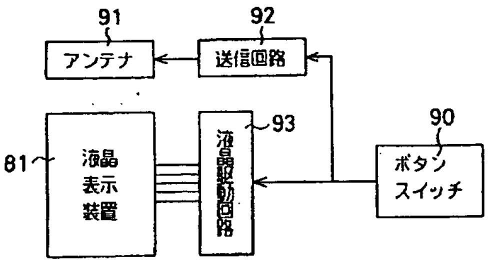


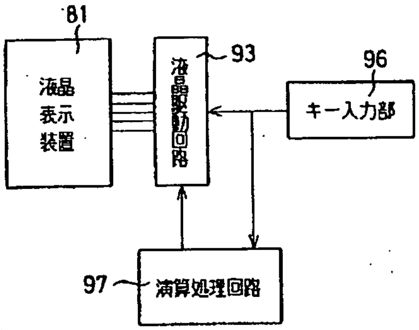
【図２１】



【図２２】



【図２４】



PATENT ABSTRACTS OF JAPAN

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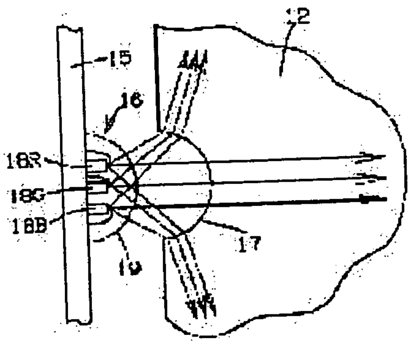
AOYAMA SHIGERU

(54) SURFACE LIGHT SOURCE DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide non-coloring excellent white color by combining plural light emitting bodies having different light emitting wavelengths in a surface light source device.

SOLUTION: LED chips 18R, 18G, 18B whose light emitting colors are red, green, and blue are closely arranged on a circuit board 15, and are sealed by transparent resin 19 so as to form a light emitting body group 16. The respective LED chips 18R, 18G, 18B of the light emitting group 16 radiate red light, green light, and blue light from close positions, the radiated red color, the green color, and the blue color are reflected, deflected on a boundary face, and mixed so as to be radiated from the light emitting group 16 as white light to a light guide plate 12.



LEGAL STATUS

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[JP,10-247411,A]

CLAIMS

[Claim(s)]
[Claim 1] The aforementioned light emitting device is surface light source equipment characterized by having the emitter group formed by carrying out contiguity arrangement of two or more emitters with which luminescence wavelength differs in surface light source equipment equipped with the light emitting device which made light counter the end face of the light guide plate for carrying out outgoing radiation, and the light guide plate concerned from a principal plane on the other hand.

[Claim 2] Surface light source equipment according to claim 1 with which the aforementioned light emitting device is characterized by having two or more aforementioned emitter groups.

[Claim 3] Surface light source equipment according to claim 1 characterized by forming a reflective barrier in the both sides of the aforementioned emitter group.

[Claim 4] Surface light source equipment according to claim 1 characterized by closing the aforementioned emitter group by the resin.

[Claim 5] Surface light source equipment according to claim 1 which is made to counter the aforementioned emitter group and is characterized by forming an optical diffusion pattern in the end face of a light guide plate.

[Claim 6] Surface light source equipment according to claim 1 characterized by making it the luminescence power as the whole emitter of the same wavelength which constitutes the aforementioned emitter group become almost the same on each wavelength.

[Claim 7] The emitter which constitutes the aforementioned emitter group is surface light source equipment according to claim 1 characterized by being symmetrically arranged for every wavelength.

[Claim 8] The emitter of the same wavelength which constitutes the aforementioned emitter group is surface light source equipment according to claim 1 characterized by being arranged so that the interval between emitters may become almost equal.

[Claim 9] Surface light source equipment characterized by consisting of a light guide plate for introducing light and on the other hand than a principal plane carrying out outgoing radiation of the light, and two or more emitters with which luminescence wavelength differs, and making it the luminescence power as the whole emitter of the same wavelength become almost the same from an end face on each wavelength in the surface light source equipment with which each emitter made the aforementioned end face of a light guide plate counter, and was distributed on the other hand.

[Claim 10] Surface light source equipment characterized by having arranged so that it may consist of a light guide plate for introducing light and on the other hand than a principal plane carrying out outgoing radiation of the light, and two or more emitters with which luminescence wavelength differs, each emitter may give priority over an end face to each emitter with which wavelength differs from an emitter with little emitter number in the surface light source equipment which was made to counter the aforementioned end face of a light guide plate, and was distributed on the other hand and it may become almost equal.

[Claim 11] Surface light source equipment according to claim 9 characterized by adjusting power consumption at the time of use of each emitter so that the luminescence power as the whole emitter of the same wavelength may become almost the same on each wavelength.

[Claim 12] Surface light source equipment according to claim 9 or 10 characterized by having made the emitter with the amount of luminescence there being comparatively few light sources and big counter, having established the optical high diffusion means of a diffusion, having made the emitter with the amount of luminescence there being comparatively many light sources and small counter, and establishing the low light diffusion means of a diffusion.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to surface light source equipment. Especially, it is related with red (R), green (G), and the surface light source equipment using the light emitting device equipped with the emitter group which consists of light emitting diode of three blue (B) colors.

[0002]
[Description of the Prior Art] If it is in surface light source equipment equipped with the monochromatic emitter, the light emitting device which mounted two or more monochromatic (for example, green) light emitting diode (henceforth Light Emitting Diode) chips on the circuit board is made to counter the end face (optical incidence end face) of a light guide plate.

[0003] Even if it is in the surface light source equipment used for electrochromatic display display, it is constituted like this, and as shown in drawing 1 , the Light Emitting Diode chips 3R, 3G, and 3B of three colors of red (R), green (G), and blue (B) make it arrange for every constant pitch along with the circuit board 2, and the light emitting device 1 is formed. And this light emitting device 1 was made to counter the optical incidence end face 5 of a light guide plate 4, and is arranged.

[0004] However, when such a light emitting device was used, there was a problem that the light which comes out from an optical outgoing radiation side near the optical incidence end face of a light guide plate colored in rainbow color. That is, since three colors of red, green, and blue were not uniformly mixed near the light emitting device, just before the Light Emitting Diode chip of each color of red, green, and blue, it colored in red, green, and blue, respectively, and it became color mixture, and unless it separated from the optical incidence end face to some extent, the white light was not able to be acquired in those middle. For this reason, on surface light source equipment, about the liquid crystal display panel for colors, when a liquid crystal display was constituted in piles, the problem that the picture of a liquid crystal display panel colored at the end was. Or when it was going to prevent coloring of a picture, it is necessary to make it not use near the optical incidence end face of a surface light source element, the use efficiency of surface light source equipment fell, and there was a problem that surface light source equipment became large as compared with a required luminescence area.

[0005]
[Problem(s) to be Solved by the Invention] this invention is made in view of the fault of the conventional example on **, and the place made into the purpose is to offer the surface light source equipment using the light emitting device which can acquire the good white light which two or more emitters which have different luminescence wavelength combine, and therefore does not have coloring.

[0006]

[Description of the Invention] In surface light source equipment equipped with the light emitting device which made light counter the end face of the light guide plate for carrying out outgoing radiation of the surface light source equipment according to claim 1 from a principal plane, and the light guide plate concerned on the other hand, the aforementioned light emitting device is characterized by having the emitter group formed by carrying out contiguity arrangement of two or more emitters with which luminescence wavelength differs.

[0007] If conventional surface light source equipment is in the surface light source equipment of a claim 1 to having mixed and whitened the light of the wavelength which came out of the emitter within the light guide plate, contiguity arrangement of the emitter with which luminescence wavelength differs is carried out, the emitter group is formed, the light from which wavelength differs by the emitter group is mixed, and outgoing radiation is carried out to a light guide plate as the white light.

[0008] Therefore, coloring of the light which comes out of a light guide plate at the edge by the side of the optical incidence of a light guide plate is reduced sharply, and can acquire the good white light.

[0009] especially -- If two or more emitter groups are prepared, the light emitting device same with having established two or more white point light sources can be obtained, it can color, when it is a big light guide plate, and outgoing radiation of the white light can be carried out that there is nothing.

[0010] Moreover, dispersion in light guide plate incident-light brightness angular distribution can be made small by forming a reflective barrier in the both sides of an emitter group, or closing an emitter group by the resin, or making an emitter group counter and forming an optical diffusion pattern in the end face of a light guide plate.

[0011] Furthermore, if it is made for the luminescence power as the whole emitter of the same wavelength which constitutes an emitter group to become almost the same on each wavelength, it can adjust brightness dispersion of each emitter and can acquire the white light good as a whole.

[0012] Moreover, if the emitter which constitutes an emitter group is symmetrically arranged for every wavelength, being wavelength distributed [of light] becomes symmetrical and the good white light of an optical property can be acquired.

[0013] Furthermore, if the emitter of the same wavelength which constitutes an emitter group is arranged so that the interval between emitters may become almost equal, the brightness unevenness of the light of each wavelength can be abolished and coloring of the white light can be reduced further.

[0014] The light guide plate for surface light source equipment according to claim 9 introducing light from an end face on the other hand, and on the other hand than a principal plane carrying out outgoing radiation of the light, It is characterized by consisting of two or more emitters with which luminescence wavelength differs, and making it each emitter become almost the same [the luminescence power as the whole emitter of the same wavelength] on each wavelength in the surface light source equipment which was made to counter the aforementioned end face of a light guide plate, and was distributed.

[0015] For example, also besides adjusting the emitter number, the luminescence power as the whole emitter of the same wavelength can also adjust power consumption at the time of use of each emitter so that it may become almost the same on each wavelength.

[0016] When two or more emitters with which wavelength differs are distributed along with a light guide plate, and making it the whole luminescence power become almost the same for every emitter of each wavelength, the quantity of light which comes out of the emitter of each wavelength becomes almost equal, and coloring of the white light can be reduced.

[0017] Surface light source equipment according to claim 10 is arranged so that it may consist of a light guide plate for introducing light and on the other hand than a principal plane carrying out outgoing radiation of the light, and two or more emitters with which luminescence wavelength differs, each emitter may give priority over an end face to each emitter with which wavelength differs from an emitter with little emitter number in the surface light source equipment which was made to counter the aforementioned end face of a light guide plate, and was distributed on the other hand and it may become almost equal.

[0018] Since each emitter is arranged so that priority may be given from an emitter with little emitter number and an emitter interval may become almost equal if it is in this surface light source equipment, the light of each luminescence wavelength can be equated rationally and an irregular color can be abolished easily.

[0019] Since the property of an element can be compensated by making an emitter with the amount of luminescence there being comparatively few light sources and big counter, establishing the optical high diffusion means of a diffusion, making an emitter with the amount of luminescence there being comparatively many light sources and small counter, and establishing the low optical diffusion means of a diffusion, the white light source as for which coloring becomes empty and which is not can be obtained.

[0020]
[Embodiments of the Invention] Drawing 2 is the plan showing the surface light source equipment 11 by 1 operation form of this invention. The diffusion pattern (not shown) formed of concavo-convex processing, dot printing of diffusion ink, etc. gives change of suitable density and density to the undersurface of the light guide plate 12 which consists of transparent resin material of a high refractive index, such as polycarbonate resin and methacrylic resin, and is formed in it. The light emitting device 14 has countered the optical incidence end face 13 of a light guide plate 12. This light emitting device 14 sets two or more emitter groups 16 in the front face of the circuit board 15, and forms a suitable interval in it, the optical incidence end face 13 of a light guide plate 12 is countered with the emitter group 16, and the circular crevice 17 is formed in it. Moreover, the reflective sheet (not shown) for preventing loss by the leakage of light is arranged in the undersurface of a light guide plate 12.

[0021] This one emitter group 16 is shown in drawing 3 . The luminescent color makes three Light Emitting Diode chip 18B of the Light Emitting Diode chip 18G and blue (B) of red (R) Light Emitting Diode chip 18R and green (G) approach, mounts the emitter group 16 in the circuit board 15, and closes it with the transparent resin 19. If a deer is carried out and each Light Emitting Diode chips 18R, 18G, and 18B of the emitter group 16 emit light, since each Light Emitting Diode chips 18R, 18G, and 18B approach and are arranged in the emitter group 16, outgoing radiation of the white light is carried out from the emitter group 16. A white light which came out of this emitter group 16 goes into the light guide plate 12 interior from the optical incidence end face 13 of a light guide plate 12. At this time, the light which enters in a light guide plate 12 from a crevice 17 can be refracted and extended also in a longitudinal direction by the curve of a crevice 17, as shown in drawing 3 , and it spreads uniformly in the light guide plate 12 whole. If it is scattered about by the diffusion pattern and the incident angle to the optical outgoing radiation side 20 (upper surface) of a light guide plate 12 becomes smaller than the critical angle of total reflection while carrying out total reflection by light guide plate 12 inside, outgoing radiation of the light included in the light guide plate 12 interior will be carried out from the optical outgoing radiation side 20.

[0022] Therefore, if it is in this surface light source equipment 11, since outgoing radiation of the white light which mixed red, green, and the blue glow and was generated from each emitter group 16 is carried out, a light emitting device 14 can be used as the white light source, and coloring of the light which comes out from the optical outgoing radiation side 20 of a light guide plate 12 also near the optical incidence end face 13 is reduced. From each Light Emitting Diode chips 18R, 18G, and 18B of since especially this emitter group 16 has wrapped three Light Emitting Diode chips 18R, 18G, and 18B in the transparent resin 19, by the interface of the transparent resin 19, the red light by which outgoing radiation was carried out, green light, and a blue glow repeat refraction and reflection, and are mixed. Although brightness angular distribution (light guide plate incident-light brightness angular distribution) will change with differences in each color of light which carry out incidence to a light guide plate 12 in the case of having only put three Light Emitting Diode chips 18R, 18G, and 18B in order, as a result of mixing the light of each color by the transparent resin 19, the difference of light guide plate incident-light brightness angular distribution also becomes small, and the more uniform white light source is obtained.

[0023] Therefore, according to the surface light source equipment 11 using the light emitting device 14 of this invention, the optical incidence end face 13 does not have coloring, either, and it can use as the good white surface light source which has uniform luminance distribution.

[0024] (The 2- 5th operation gestalt) In order for light guide plate incident-light brightness angular distribution to prevent differing for every Light Emitting Diode chip from which the luminescent color differs again, the various structures where it explains below are also employable.

[0025] The emitter group 16 shown in drawing 5 forms a reflective barrier 21 in the right-and-left both sides of three Light Emitting Diode chips 18R, 18G, and 18B closed with the transparent resin 19. By forming a reflective barrier 21 in both sides, the light which came out of each Light Emitting Diode chips 18R, 18G, and 18B is reflected by the reflective barrier 21, the angle of light is changed, and while forming the white light source by carrying out the longitudinal dispersion of the light of each color, the difference in light guide plate incident-light brightness angular distribution is made small.

[0026] The emitter group 16 shown in drawing 6 forms a reflective barrier 21 in the right-and-left both sides of three Light Emitting Diode chips, and closes each Light Emitting Diode chips 18R, 18G, and 18B and a reflective barrier 21 in the transparent resin 19. Even if it is in this operation gestalt, by forming a reflective barrier 21 in both sides, the light which came out of each Light Emitting Diode chips 18R, 18G, and 18B is reflected by the reflective barrier 21, the angle of light is changed, and while forming the white light source by carrying out the longitudinal dispersion of the light of each color, the difference in light guide plate incident-light brightness angular distribution is made small.

[0027] The emitter group 16 shown in drawing 7 forms a reflective barrier 21 in the vertical both sides of three Light Emitting Diode chips 18R, 18G, and 18B closed with the transparent resin 19. By forming a reflective barrier 21 up and down, the light which came out of each Light Emitting Diode chips 18R, 18G, and 18B is reflected by the reflective barrier 21, the angle of light is changed, and while forming the white light source by carrying out the longitudinal dispersion of the light of each color, the difference in light guide plate incident-light brightness angular distribution is made small.

[0028] The operation gestalt shown in drawing 8 forms in the crevice 17 of a light guide plate 12 random or the optical diffusion pattern 22 which consists of irregularity of a predetermined pattern. If it is in this operation gestalt, the light which came out of each Light Emitting Diode chips 18R, 18G, and 18B can make small the difference in light guide plate incident-light brightness angular distribution while it equalizes the luminance distribution of light more since it enters in a light guide plate 12 in an irregular direction, being scattered about by the optical diffusion pattern 22, in case incidence is carried out into a light guide plate 12 from a crevice 17.

[0029] (6th operation gestalt) Drawing 9 (a) expresses one emitter group 16 of the light emitting device 14 by still more nearly another operation gestalt of this invention. If it is in this emitter group 16, two or more sets of each color Light Emitting Diode chips 18R, 18G, and 18B are arranged on the circuit board 15 in two or more steps, and each Light Emitting Diode chips 18R, 18G, and 18B are closed by the transparent resin 19. Thus, if the Light Emitting Diode chips 18R, 18G, and 18B are arranged to two or more steps, since the width of face of the Light Emitting Diode chips 18R and 18G at the time of seeing a light emitting device 14 from the upper part and the whole 18B will become small, dispersion in the light guide plate incident-light brightness angular distribution by the array of the Light Emitting Diode chips 18R, 18G, and 18B with which the luminescent color differs can be made small.

[0030] As especially shown in drawing 9 (b), it is desirable to make the list of the luminescent color reverse in an upper case and the lower berth. If an array is made reverse, much more effect is in whitening of the light source, and reduction of dispersion in light guide plate incident-light brightness angular distribution.

[0031] (Operation gestalt of the 7th octavus) If it is in the above-mentioned operation gestalt, each uses the red Light Emitting Diode chip, the green Light Emitting Diode chip, and the blue Light Emitting Diode chip the same number every. However, the luminescence power of a Light Emitting Diode chip changes with each efficiency of element, maximum rating, etc., and the ratio of each maximum luminescence power PR, PG, and PB of a red Light Emitting Diode chip, a green Light Emitting Diode chip, and a blue Light Emitting Diode chip has become about PR:PG:PB=8:1:4. Therefore, in each emitter group 16 of a light emitting device 14, it is desirable the use number of the Light Emitting Diode chips 18R, 18G, and 18B of each color become one piece about red Light Emitting Diode chip 18R, to make eight pieces and blue Light Emitting Diode chip 18B become four ratios about green Light Emitting Diode chip 18G, and to make luminescence power for every color equal.

[0032] However, colors will differ by right and left only by arranging [B / blue Light Emitting Diode chip 18/ [B only shows a view] / eight / 4[is only shown by G view] / R / one red Light Emitting Diode chip 18/ [R only shows a view]] / like drawing 10 , for example. / green Light Emitting Diode chip 18G In order to arrange these Light Emitting Diode chips 18R, 18G, and 18B, as shown in drawing 11 , Light Emitting Diode chip (red) 18R with few numbers is assigned so that it may become equal to an arrangement field first, next, Light Emitting Diode chip (blue) 18B with few numbers is assigned to the blank position of an arrangement field equally [abbreviation], and, finally most numerous Light Emitting Diode chip (green) 18G are assigned to the position which has opened.

[0033] Moreover, in order to make more into homogeneity light which comes out of each Light Emitting Diode chips 18R, 18G, and 18B, as shown in drawing 12 , the Light Emitting Diode chips 18R, 18G, and 18B of each color may be arranged in homogeneity to an arrangement field, respectively, and you may arrange to a single tier as it is.

[0034] As for each Light Emitting Diode chips 18R, 18G, and 18B, the array of drawing 11 or the array of drawing 12 is also arranged by the bilateral symmetry. in an array still like drawing 11 Since the interval of the Light Emitting Diode chips 18R, 18G, and 18B becomes fixed, mounting to the circuit board 15 of the Light Emitting Diode chips 18R, 18G, and 18B becomes easy, in an array like drawing 12 , the uniformity coefficient of the luminescence power of each color becomes high, and an effect is in white light source-ization.

[0035] In addition, although not illustrated, the Light Emitting Diode chips 18R, 18G, and 18B of each color are not driven by the maximum rating, but at the time of use of each Light Emitting Diode chips 18R, 18G, and 18B, it is with red Light Emitting Diode chip 18R, Light Emitting Diode chip 18G [green], and blue Light Emitting Diode chip 18B, and the method it is made to become about 1:2:8 is also effective [power consumption].

[0036] (9th operation gestalt) Although the old operation gestalt was formed into the white point light source by making the Light Emitting Diode chips 18R, 18G, and 18B of each color approach as an emitter group 16, and arranging them What is shown in drawing 13 attains whitening of surface light source equipment by arranging the Light Emitting Diode chips 18R, 18G, and 18B with which the luminescent color differs along with the optical incidence end face 13 of a light guide plate 12.

[0037] That is, what is shown in drawing 13 uses arrangement (drawing 11) of the Light Emitting Diode chips 18R, 18G, and 18B decided like the 7th operation form in consideration of the ratio of the luminescence power of the Light Emitting Diode chips 18R, 18G, and 18B of each color. With the 7th operation form, although it was arrangement of the Light Emitting Diode chips 18R, 18G, and 18B in the interior of the emitter group 16, it uses for the array of the Light Emitting Diode chips 18R, 18G, and 18B in alignment with the optical incidence end face 13 of a light guide plate 12 in this example.

[0038] Even when the Light Emitting Diode chips 18R, 18G, and 18B of each color are arranged to the optical incidence end face 13 of a light guide plate 12 in such an array, the whole color balance becomes good, it can consider as the good white light source, and coloring in the optical outgoing radiation side 20 of a light guide plate 12 can be lessened.

[0039] (10th operation gestalt) The Light Emitting Diode chips 18R, 18G, and 18B of each color are made for the interval of the Light Emitting Diode chip for every color to become uniform like the operation gestalt of the octavus again as for what is shown in drawing 14 although the interval between each Light Emitting Diode chips 18R and 18G and 18B is uneven (refer to drawing 12).

[0040] Even when the Light Emitting Diode chips 18R, 18G, and 18B of each color are arranged to the optical incidence end face 13 of a light guide plate 12 in such an array, the whole color balance becomes good, it can consider as the good white light source, and coloring in the optical outgoing radiation side 20 of a light guide plate 12 can be lessened.

[0041] In addition, you can extend the light of each [which will carry out incidence to a light guide plate 12 if the optical diffusion pattern 22 is formed as a crevice 17 is established in the light incidence end face 13 of a light guide plate 12 or the position which counters each Light Emitting Diode chips 18R and 18G or 18B as shown in drawing 15 is shown in drawing 16] color right and left within a light guide plate 12, and can make it distributed uniformly within a light guide plate 12.

[0042] (11th operation form) Drawing 17 is the plan showing the surface light source equipment by still more nearly another operation form of this invention. With this operation form, the optical incidence end face 13 of a light guide plate 12 was made to counter, and it has prepared [G / eight green Light Emitting Diode chip 18/ [each Light Emitting Diode chips 18R, 18G, and 18B are only expressed with R, G, and B at drawing 17] / one red Light Emitting Diode chip 18R, two blue Light Emitting Diode chip 18B, and] by the same arrangement as drawing 16 . in this way, in red Light Emitting Diode chip 18R and the position which counters, the Light Emitting Diode chips 18R, 18G, and 18B among the optical incidence end faces 13 by which opposite arrangement was carried out Crevice 17R with deep depth as shown in drawing 18 (a) and (b) was prepared, crevice 17G with shallow depth as shown in drawing 19 (a) and (b) were prepared in green Light Emitting Diode chip 18G and the position which counters, and crevice 17B of the middle depth is prepared in blue Light Emitting Diode chip 18B and the position which counters.

[0043] Although the spreading effect of the light which carries out incidence to a light guide plate 12 becomes high in crevice 17R with deep depth as shown in drawing 18 (a) and (b), since the quantity of light which leaks from the space of crevice 17R to the slanting upper and lower sides increases, the joint efficiency of a Light Emitting Diode chip and a light guide plate 12 becomes small. On the contrary, although the spreading effect of the light which carries out incidence to a light guide plate 12 becomes small in crevice 17G with shallow depth as shown in drawing 19 (a) and (b), the joint efficiency of a Light Emitting Diode chip and a light guide plate 12 becomes high. Since red Light Emitting Diode chip 18R has high joint efficiency with a light guide plate 12 and there is little use number The crevice combined with red Light Emitting Diode chip 18R is made into what has deep depth (17R). green Light Emitting Diode chip 18G Since joint efficiency with a light guide plate 12 is low and there is much use number, the crevice combined with green Light Emitting Diode chip 18G is made into what has shallow depth (17G). blue Light Emitting Diode chip 18B Since joint efficiency with a light guide plate 12 is low and there is much use number, the crevice combined with blue Light Emitting Diode chip 18B by considering as the thing (17B) of middle depth While making the optical coupling efficiency of each Light Emitting Diode chips 18R, 18G, and 18B balance, it can be made the diffusion condition nearby homogeneity of light, and luminance distribution can obtain the uniform white surface light source by high brightness.

[0044] (Liquid crystal display) Drawing 20 is the decomposition perspective diagram showing the liquid crystal display 81 using the surface light source equipment 80 concerning this invention. The diffuse reflection sheet 82 is arranged in the front face of surface light source equipment 80, and the liquid crystal display panel 83 is arranged in the front face. The liquid crystal display panel 83 closes liquid crystal material between two liquid crystal substrates (a glass substrate, film substrate) 84 which had a transparent electrode, TFT, the light filter, the black matrix, etc. formed, and 85, and arranges a polarizing plate 86 in both the external surface of the liquid crystal substrates 84 and 85.

[0045] (Electronic instrument equipped with the liquid crystal display) The liquid crystal display concerning this invention is desirable although used for a radio data transmission unit like a cellular phone or a weak-electric-current force walkie-talkie, a portable personal computer, an electronic notebook, an information processor like a calculator, etc. The perspective diagram and drawing 22 which show the cellular phone 89 which equipped the display with the liquid crystal display 81 which drawing 21 requires for this invention as shown, for example in drawing 20 are the functional block diagram. The transverse plane of a cellular phone 89 is equipped with the button switches 90, such as a ten key for a dial input, a liquid crystal display 81 is arranged in the upper part, and the antenna 91 is formed in the upper surface. If a deer is carried out and a dial etc. is inputted from a button switch 90, the inputted dial information will be transmitted to the base station of the telephone company from an antenna 91 through a sending circuit 92. On the other hand, the inputted dial information is sent to the liquid crystal drive circuit 93, a liquid crystal display 81 drives by the liquid crystal drive circuit 93, and dial information etc. is displayed on a liquid crystal display 81.

[0046] Moreover, the perspective diagram and drawing 24 which show the Personal Digital Assistant machines 94 which equipped the display with the liquid crystal display 81 which drawing 23 requires for this invention as shown, for example in drawing 20 , such as an electronic notebook and a portable personal computer, are the functional block diagram. If the Personal Digital Assistant machine 94 opens covering 95, it has the key input section 96 and the liquid crystal display 81, and the liquid crystal drive circuit 93 and the data-processing circuit 97 grade are prepared in the interior. If a deer is carried out, for example, a ten key, a kana key, etc. are inputted from the key input section 96, input will be sent to the liquid crystal drive circuit 93, and will be displayed on a liquid crystal display 81. Subsequently, if control keys, such as an operator key, are pushed, processing and an operation predetermined in the data-processing circuit 97 are performed, and the result will be sent to the liquid crystal drive circuit 93, and will be displayed on a liquid crystal display 81.

[0047] In addition, in the light emitting device of each above-mentioned operation gestalt, although the Light Emitting Diode chip or the emitter group was formed on the circuit board, it may be the light emitting device of a type which mounted these in the lead.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the outline plan showing conventional surface light source equipment.
[Drawing 2] It is the plan showing the surface light source equipment by 1 operation gestalt of this invention.
[Drawing 3] It is operation explanatory drawing same as the above.
[Drawing 4] It is operation explanatory drawing same as the above.
[Drawing 5] It is the schematic diagram showing the emitter group by another operation gestalt of this invention.
[Drawing 6] It is the schematic diagram showing the emitter group by still more nearly another operation gestalt of this invention.
[Drawing 7] It is the perspective diagram showing the emitter group by still more nearly another operation gestalt of this invention.
[Drawing 8] It is the schematic diagram showing the crevice of the emitter group by still more nearly another operation gestalt of this invention, and a light guide plate.
[Drawing 9] The perspective diagram showing the emitter group according [(a)] to still more nearly another operation gestalt of this invention and (b) are drawings showing arrangement of the Light Emitting Diode chip in the emitter group concerned.
[Drawing 10] It is drawing showing an example of the array of the Light Emitting Diode chip of three colors.
[Drawing 11] It is drawing for explaining the array of a desirable Light Emitting Diode chip.
[Drawing 12] It is drawing for explaining the array of a desirable Light Emitting Diode chip.
[Drawing 13] It is drawing showing the array of the Light Emitting Diode chip in the surface light source equipment by still more nearly another operation gestalt of this invention.
[Drawing 14] It is drawing showing the array of the Light Emitting Diode chip in the surface light source equipment by still more nearly another operation gestalt of this invention.
[Drawing 15] It is the plan which the surface light source equipment by still more nearly another operation gestalt of this invention fractured the part.
[Drawing 16] It is the plan which the surface light source equipment by still more nearly another operation gestalt of this invention fractured the part.
[Drawing 17] It is the outline plan showing the surface light source equipment by still more nearly another operation gestalt of this invention.
[Drawing 18] (a) and (b) are operation explanatory drawings same as the above.
[Drawing 19] (a) and (b) are operation explanatory drawings same as the above.
[Drawing 20] It is the decomposition perspective diagram of the liquid crystal display using the surface light source equipment of this invention.
[Drawing 21] It is the perspective diagram showing the cellular phone which equipped the display with the liquid crystal display concerning this invention.
[Drawing 22] It is the block diagram showing the composition for driving a liquid crystal display in a cellular phone same as the above.
[Drawing 23] It is the perspective diagram showing Personal Digital Assistant machines, such as an electronic notebook which equipped the display with the liquid crystal display concerning this invention.
[Drawing 24] It is the block diagram showing the composition for driving a liquid crystal display in a Personal Digital Assistant machine same as the above.
[Description of Notations]
12 Light Guide Plate
13 Optical Incidence End Face
14 Light Emitting Device

15 Circuit Board
16 Emitter Group
18R, 18G, 18B Light Emitting Diode chip
19 Transparent Resin
21 Reflective Barrier
22 Optical Diffusion Pattern

* NOTICES *

Japan Patent Office is not responsible for any damages caused by the use of this translation.

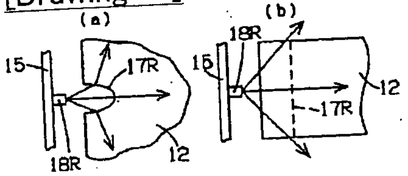
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

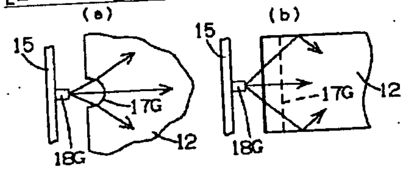
[Drawing 10]

B	B	G	G	G	G	G	G	G	G	R

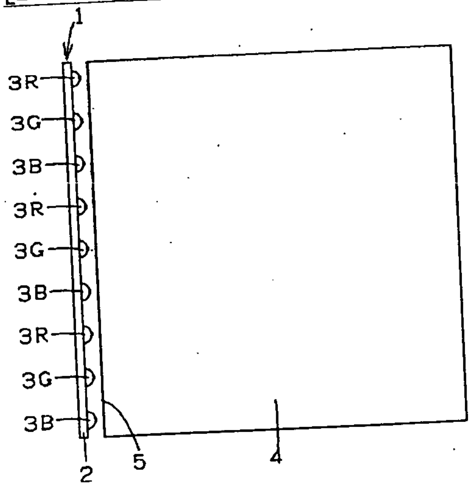
[Drawing 18]



[Drawing 19]



[Drawing 1]



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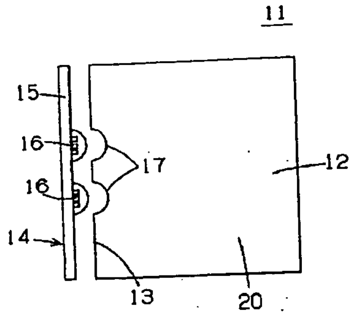

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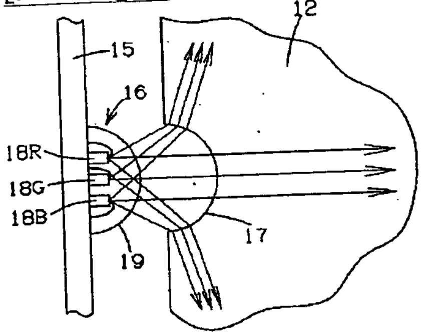

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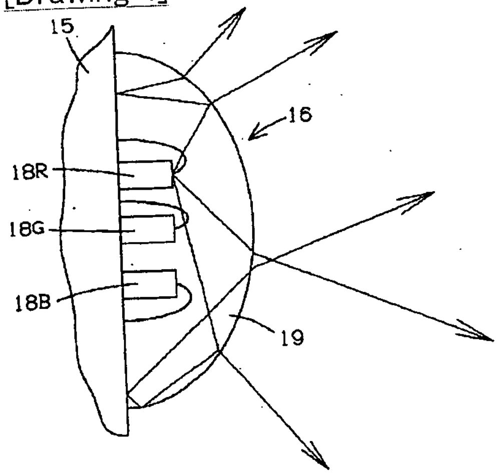

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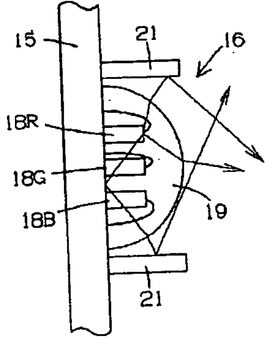

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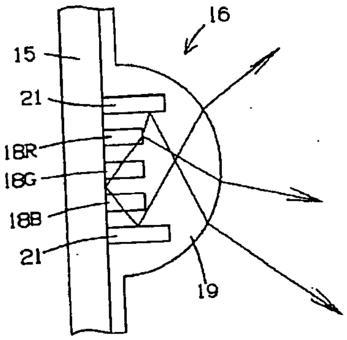

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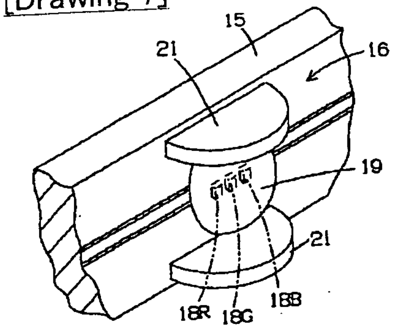
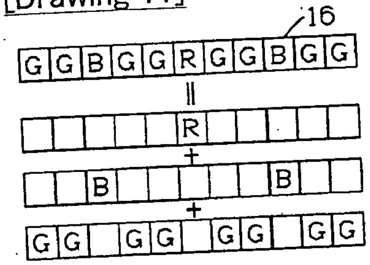
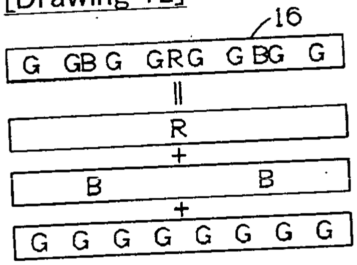


[Drawing 11]



[Drawing 12]



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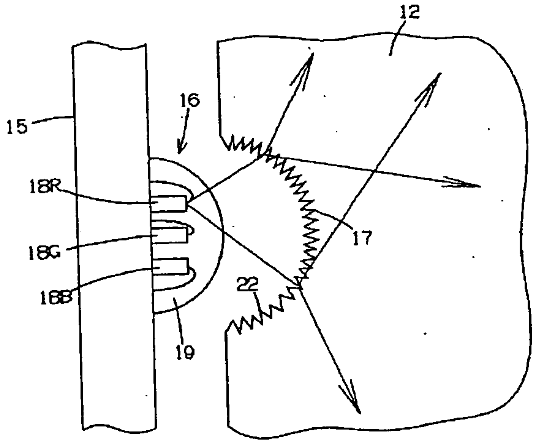

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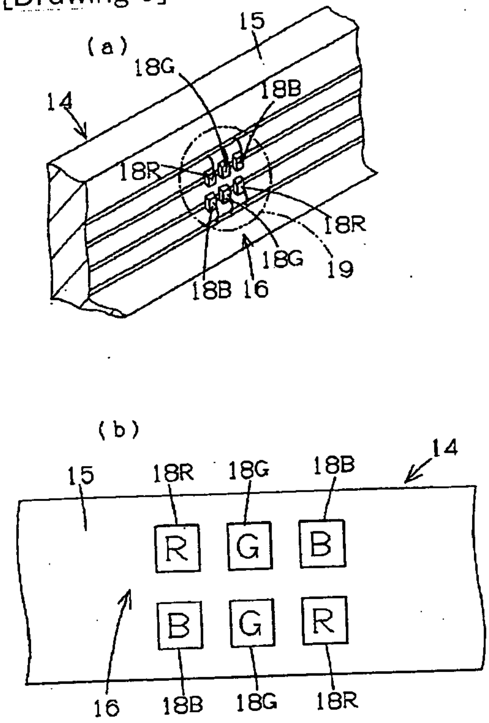
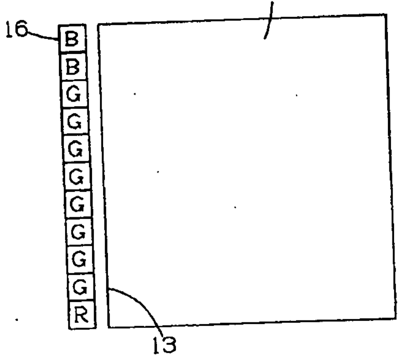


[Drawing 13]



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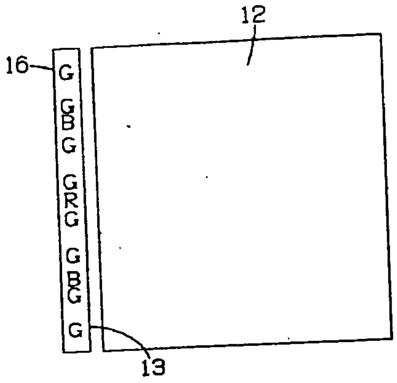
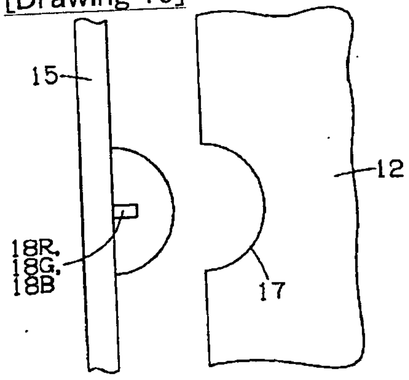


[Drawing 15]



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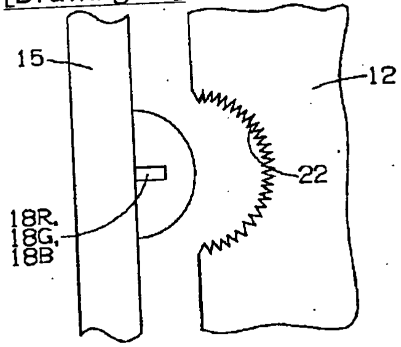
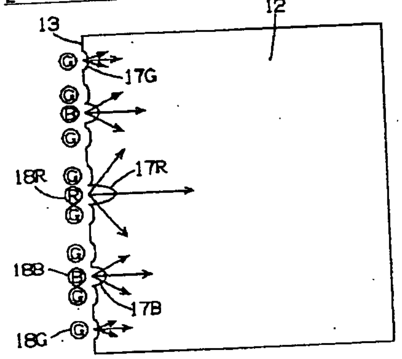
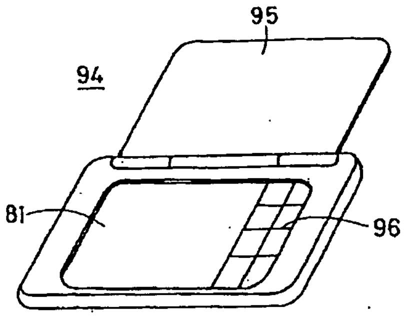


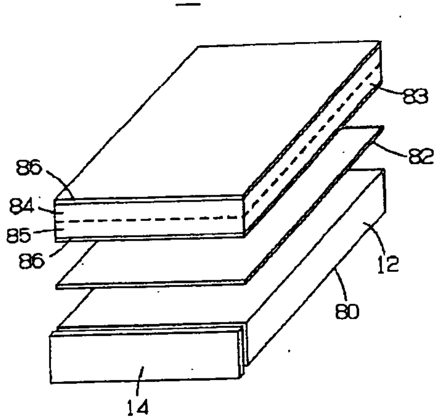
[Drawing 17]



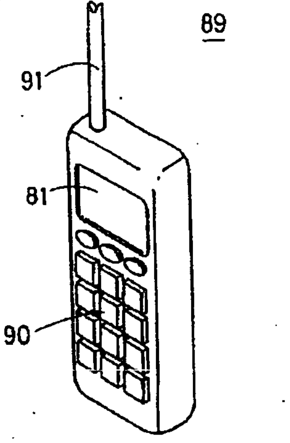
[Drawing 23]



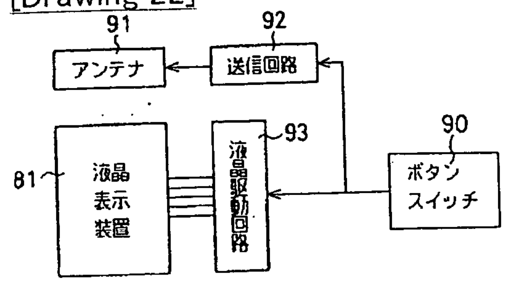
[Drawing 20]



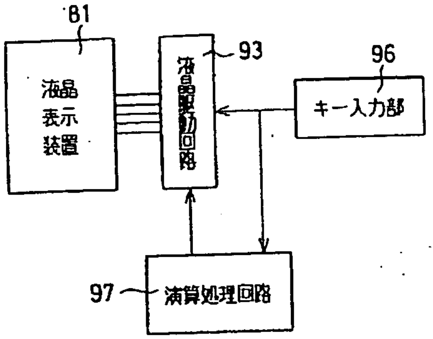
[Drawing 21]



[Drawing 22]



[Drawing 24]



[Translation done.]